REMARKS

Claims 4-7 are currently pending in this application. Claims 4-7 are amended. It is respectfully submitted that no new matter was presented in the substitute specification filed on June 10, 2002. Accordingly, Applicant requests that the substitute specification be entered. The drawings are amended to more clearly show the features of the claimed invention. No new matter is presented. The foregoing amendments and following remarks are considered by Applicant to overcome each rejection raised in the Office Action and to place the application in condition for allowance. Accordingly, Applicant requests reconsideration of claims 4-7.

The Examiner objected to the drawings as having poor quality. The Examiner also objected to the drawings for failing to show every feature recited in the claims. Specifically, the Examiner indicated that the filter holder having a marking as recited in claim 5 is not shown in the drawings. The filter holder is provided as the filter module in the specification and therefore does not constitute new matter. (See Page 3, Lines 26-29) The drawings are amended to illustrate this feature. Substitute drawings illustrating all the features in the recited claims are submitted. No new matter is presented, as the filter module is fully supported in the specification. Accordingly, Applicants request the withdrawal of the objection to the drawings.

Claims 6 and 7 were objected to for being in improper form. Claim 4 is amended to more clearly recite the invention. Accordingly, it is submitted that claims 6 and 7 now are in proper form and overcome the objection under 35 CFR 1.75(c). Therefore Applicant requests the withdrawal of the objection to claims 6 and 7.

Claims 4 and 5 were rejected under 35 U.S.C. 112, first paragraph, as failing to enable the claimed invention. Applicant respectfully disagrees with the Examiner's analysis.

Claim 4 recites a fluorescence microscope with blocking filters having a particular wedge angle being used for a portion of the light emitted by a specimen. The blocking filters are marked with respect to the orientation of their wedge angle.

The wedge angle is well known in the art as seen by the submission of the attached article found in the "Handbook of optical filters for fluorescence microscopy" (See Attached Exhibit A). The wedge angle is an important parameter used to define the overall image quality of a filter or beamsplitter. More specifically, the wedge angle is the measure of how parallel the light beams are transmitted to the outer surfaces of an optical element. Wedge is usually measured in arc-minutes or arc-seconds of angles. The main effect of wedge is to

induce an angular deviation in the direction of a light beam, causing, for example, image shifting. The amount of angular deviation is about one-half the wedge angle for a typical filter. The wedge of internal coating surfaces, while not contributing greatly to beam deviation, can cause noticeable ghost images as a result of the off-axis internal reflections. As can be seen in Exhibit A, the term wedge angle is a well known term of art in the optical filters of fluorescence microscopy.

Therefore, Applicant respectfully submits that claims 4 and 5 overcome the 112, first paragraph rejection. Accordingly, Applicant requests the withdrawal of the rejection of claims 4 and 5 under 35 U.S.C. 112, first paragraph.

Claims 4 and 5 were rejected under 35 U.S.C. 103(a) as being unpatentable Hasegawa et al. (U.S. Patent No. 6,219,180). The Examiner takes the position that Hasegawa teaches and/or suggests all the features recited in claims 4 and 5. Applicant respectfully disagrees. Hasegawa fails to teach and/or suggest all the features of the claimed invention.

The present invention of claim 4 will be explained, by way of example only, with reference to the figures of the present application. The disadvantages of the prior art are clearly shown in FIG. 2 of the present specification in which because of the difference in wedge angles between two filters A and B, there is a pixel shift for the same point of a sample being observed. In FIG. 2, a sample location using filter A appears at a location shown as an empty circle while the same sample location using filter B appears at a location shown as a solid circle. As can be appreciated, these two points for the same sample location produces a fuzzy image.

According to the invention of claim 4, however, the fluorescence microscope is provided with blocking filters with their wedge angle that are marked on the filters themselves so that the pixels for the same sample point from different color filters align along a particular axis. As shown in FIG. 3, a sample location using filter A appears at a location shown as a solid circle while the same sample location using filter B appears at a location shown as an empty circle. Those two pixels are now aligned along an x-axis. As can be appreciated, the distance between the two points is minimized. Moreover, since the distance only varies along a single axis, compensation for even clearer image becomes much simpler.

Claim 4 recites this feature as "wherein said blocking filters are marked with respect to the orientation of their wedge".

Hasegawa discloses an optical unit switching device. Hasegawa further discloses ring slits 24 a-24d that are attached to the rotatable condenser. The condenser 7 comprises a turret section 52 as a rotatable movable member. The turret section also contains four stepped

sections 63, in which four ring slits 24a-24d are fitted. In the bottom section 52 of the turret section 52, four V-grooves 64 each having a V-shaped cross section are formed on respective lines passing through the center points of the four stepped sections 63, and the rotary shaft 50. Hasegawa also discloses a fixed indicator 59 printed on an operation surface of the upper section of the turret section.

However, Hasegawa fails to teach and/or suggest all the features recited in claim 1. Specifically, Hasegawa fails to teach or suggest the problem the claimed invention is overcoming or the features of which the claimed invention utilizes to correct the cited problems of the blocking filters. Although, Hasegawa discloses marking the upper section of the turret section with position and type indicators, the indicators have no correlation to the wedge angle. Moreover, the Examiner admits that Hasegawa does not teach or suggest marking the blocking filters with the wedge angle. Under MPEP Section 2144.03, Applicant respectfully requests the Examiner to produce a prior art reference that teach marking the blocking filters **with respect to the orientation of the wedge**. If the Examiner cannot produce such a reference, Applicant respectfully requests the Examiner to withdraw the rejection of claim 4 under 35 U.S.C. 103(a).

In addition, claims 5-7 are dependent upon claim 4, which recites patentable subject matter, therefore for at least the reasons mentioned above, it is submitted that claims 5-7 also recites subject matter that is neither taught nor suggested by the applied references. Accordingly, Applicant requests the withdrawal of the rejection of claims 4-7 under 35 U.S.C. 103(a).

In view of the above amendments and remarks, it is respectfully submitted that the claims now pending patentability distinguish the present invention from the cited references. Claim 4-7 are amended. Replacement figures are also provided. No new matter is presented. Accordingly, reconsideration and withdrawal of the outstanding rejections and an issuance of a Notice of Allowance is respectfully requested.

Should the Examiner feel that a telephone conference with Applicant's attorney would expedite the prosecution of this application, the Examiner is urged to contact him at the number indicated below.

Respectfully submitted,

Harry K. Ahn
Reg. Number: 40,243
Telephone: 212-521-5400
Facsimile: 212-521-5450

Reed Smith LLP
599 Lexington Avenue
29th Floor
New York, NY 10022-7650

IN THE DRAWINGS

Please replace Figures 1-3 with the replacement sheets 1-3. No new matter is presented.

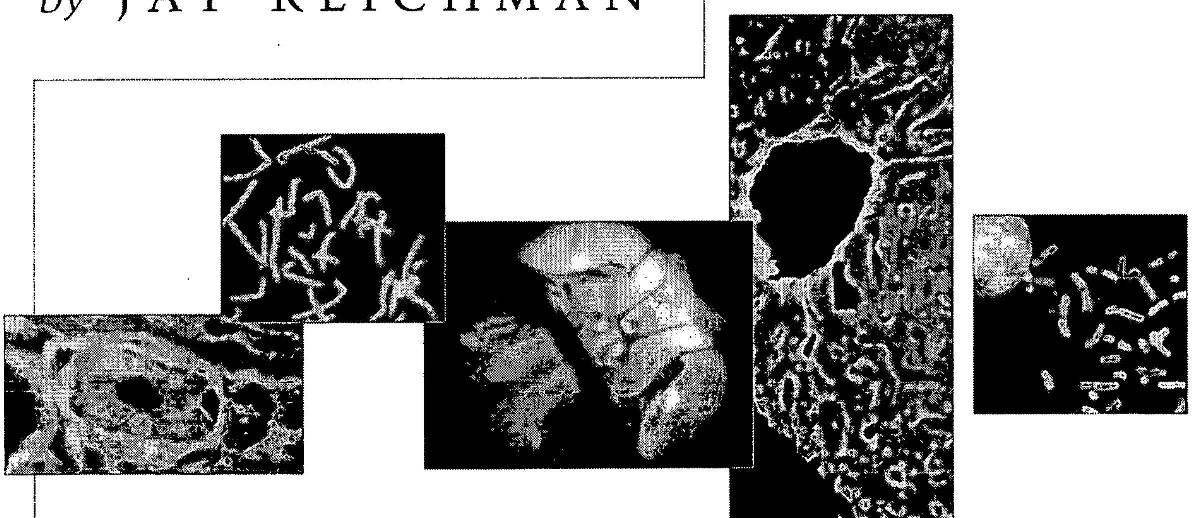
APPENDIX A

TO AMENDMENT

CHROMA TECHNOLOGY CORP

HANDBOOK *of* OPTICAL FILTERS *for* FLUORESCENCE MICROSCOPY

by JAY REICHMAN



HB1.1/June 2000

CHROMA TECHNOLOGY CORP

HANDBOOK *of* OPTICAL FILTERS *for* FLUORESCENCE MICROSCOPY

by JAY REICHMAN

Fluorescence microscopy requires optical filters that have demanding spectral and physical characteristics. These performance requirements can vary greatly depending on the specific type of microscope and the specific application. Although they are relatively minor components of a complete microscope system, optimally-designed filters can produce quite dramatic benefits, so it is useful to have a working knowledge of the principles of optical filtering as applied to fluorescence microscopy.

This guide is a compilation of the principles and know-how that the engineers at Chroma Technology Corp use to design filters for a variety of fluorescence microscopes and applications, including wide-field microscopes, confocal microscopes, and applications involving simultaneous detection of multiple fluorescent probes. Also included is information on the terms used to describe and specify optical filters and practical information on how filters can affect the optical alignment of a microscope.

Finally, the handbook ends with a glossary of terms that are italicized or in boldface in the text.

For more in-depth information about the physics and chemistry of fluorescence, applications for specific fluorescent probes, sample-preparation techniques, and microscope optics, please refer to the various texts devoted to these subjects. One useful and readily available resource is the literature on fluorescence microscopy and microscope alignment published by the microscope manufacturers.

ABOUT CHROMA TECHNOLOGY CORP

Employee-owned Chroma Technology Corp specializes in the design and manufacture of optical filters and coatings for applications that require extreme precision in color separation, optical quality, and signal purity:

- low-light-level fluorescence microscopy and cytometry
- spectrographic imaging in optical astronomy
- laser-based instrumentation
- Raman spectroscopy.

Our coating lab and optics shop are integrated into a single facility operated by a staff with decades of experience in both coating design and optical fabrication. We are dedicated to providing the optimum cost-effective solution to your filtering requirements. In most cases our staff will offer, at no extra charge, expert technical assistance in the design of your optical system and selection of suitable filtering components.

74 Cotton Mill Hill, Unit A-9, Brattleboro, Vermont 05301 USA
Telephone: 800-8-CHROMA or 802-257-1800 **Fax:** 802-257-9400 **E-mail:** sales@chroma.com
Website: www.chroma.com

OPTICAL QUALITY

The optical quality requirements for an optical filter depend very much on such factors as the type of filter (especially whether it is a component of the illumination optics or the imaging/detection optics), the type of microscope, and the intended application. For example, the optical quality specifications for an emission filter used for quantitative image analysis with a laser scanning confocal microscope are much different from those for an excitation filter used for qualitative visual observation with a standard wide-field microscope. Although specific requirements for every type of filter and every application cannot be described here, by introducing the key optical quality parameters and analyzing a few basic microscope configurations, one can develop a set of general guidelines that can be applied to most situations.

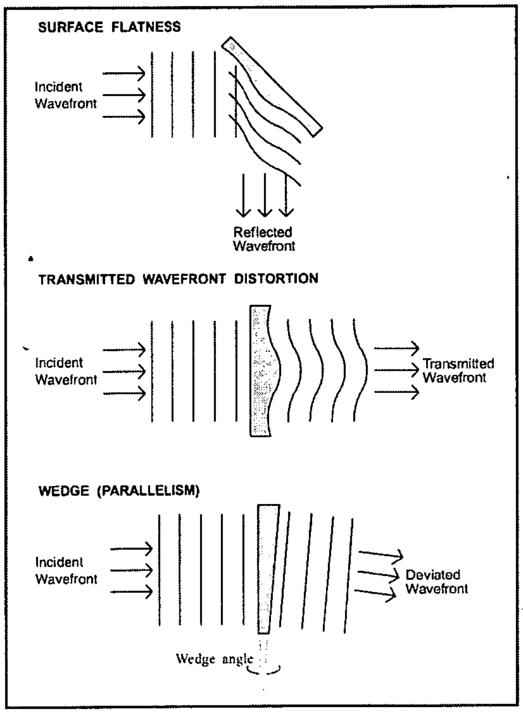


FIGURE 25
Illustration of the effects of surface flatness, transmitted wavefront distortion, and wedge.

Optical quality parameters

The following is a list of important parameters used to define the overall image quality of a filter or beamsplitter. The first three parameters are illustrated in **Figure 25.**

1) **Surface flatness** is a measure of the deviation of the surface of an optical element from a perfect plane, usually measured in fractions or multiples of a wavelength of visible light (usually 550 or 630 nm, but sometimes using the CWL for a bandpass filter). The actual wavefront distortion that a plane wave of light undergoes when reflected from the surface is twice the value of the surface flatness.[15] The wavefront distortion of light reflected off a beamsplitter or mirror is solely determined by the surface flatness of the reflecting surface, usually the front surface.

2) **Transmitted wavefront distortion (TWD)** is a measure of the distortion a plane wave of light undergoes when transmitted through an optical element, also measured in fractions or multiples of a wavelength of light, the same as for surface flatness, described above. The surface flatness of the outer surfaces of the element and, to a lesser degree, internal structures that cause inhomogeneity of the refractive index, combine to make up the overall TWD of the optical element.

3) **Wedge** (also called *parallelism*) is a measure of how parallel are the outer surfaces of an optical element. Wedge is usually measured in arc-minutes or arc-seconds of angle. The main effect of wedge is to induce an *angular deviation* in the direction of a light beam, causing, for example, image shifting. The amount of angular deviation is about one-half the wedge angle for a typical filter.[16] The wedge of internal coating surfaces, while not contributing greatly to beam deviation, can cause noticeable ghost images as a result of off-axis internal reflections.

[15] This is strictly true only for light reflected at normal incidence. The value for light reflected at non-normal incidence is modified by a cosine factor. For example, the reflected wavefront distortion at 45 degrees angle of incidence is approximately 1.4 times the surface flatness.

[16] For small angles of incidence, the angular deviation $= (N - 1)\,\alpha$, where N is the refractive index of the glass in the filter, and α is the wedge angle. Most filters use optical glass with a refractive index of approximately 1.5.